THE PLANKTON POPULATION OF A SMALL FERTILE POND IN CENTRAL OKLAHOMA

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By

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Introduction

The investigation herein described was undertaken with the idea of providing a seasonal list of the plankton organisms and their relative numbers in a fertilized pond. Knowledge concerning the kinds, numbers, and time of occurence of plankters in Oklahoma waters has been quite limited. Taft (1931, 1934, 1935a, 1935b, 1937a, 1937b, and 1940) has contributed considerable information on the Oklahoma algae. Transeau, Tiffany, Taft, and Li (1934) listed some new species of Zygnemataceae. Leake (1939) gives some information on the motile cells of Basicladia crassa, and (1945) published a list of algae from Crystal Lake. The only records of zooplankton study in Oklahoma were Mackin (1930), a new species of Cladocera, and (1931) notes on Cladoceran fauna. No attempt has been made so far to ascertain which of the organisms listed below are new records for Oklahoma.

A pool, locally known as Theta pond, is located on the south edge of the Oklahoma A. & M. College campus. It was drained and dredged to its present capacity (surface area 0.8 acre, 14 feet maximum depth) in late summer and early fall of 1943. The bed was covered with 18, 5-ton, truck-loads of sludge from the local sewage disposal plant. Again (April 9-12, 1946) several loads of sludge were added. This pond was selected for study because of its accessibility and relatively large amount of organic material.

Ice cover was seldom complete, never over 3 inches in depth, and existed no more than a week during the winter of 1945-1946. Turbidity due

to silt has been recorded as high as 260 parts per million, Irwin (1945), but was never found to be that great during the period studied. Usually the turbidity due to silt was below 25 parts per million as the pond continued to precipitate the suspended silt shortly after each run-off.

During the period of investigation, fishing for bluegill, bass, green sunfish, and catfish was allowed in the pond. Only a few records of physical and chemical conditions were made, however conditions must have been normal as the fish population showed no signs of distress.

Methods

Thirty-five weekly collections were made from the upper 1 foot of water and preserved in 10 percent formaldehyde during the period from October 18, 1945 to June 21, 1946. A quantitative sample was taken from a depth of two meters and one from the upper foot, and comparisons of the two counts showed them to be almost identical. Additional samples were collected regularly from various depths and kept alive for identification and study in the laboratory. Identifications to genera were determined mainly by the aid of Ward and Whipple (1918), Smith (1933), and Kudo (1939 and 1946).

In taking quantitative samples, a small straining net of number 20 silk bolting cloth was used to produce a concentrate from 30 liters of water. Qualitative collections were made by the use of a throw net of the same material.

All pH readings taken were between 7.6 and 9.6. Oxygen was found to be at the saturation point each time the water was tested by the use of the Rideal-Stewart modification of the Winkler method. Although water temperature was not taken at the time of each collection, the temperature is known to range from 32° F. to 90° F.

A Spencer compound microscope equipped with a 10x eyepiece and a 16 millimeter objective was used in combination with a Whipple ocular micrometer and a Sedgwick-Rafter counting chamber for counting. The procedure used in determining population was to count individual organisms or colonies in 10 ocular micrometer fields selected at random, average the numbers, and compute the population per liter.

Biological Features of the Pond Water

I. Phytoplankton

The Euglenophyceae, represented by 7 genera, was by far the most abundant group of the algae. Cryptoglena was the dominant genus. This one genus dropped to less than half the total plankton only during May and June. The Euglenophyceae present were:

1. Astasia
2. Cryptoglena
3. Euglena
4. Euglenamorpha
5. Lepocinclis
6. Phacus
7. Trachelomonas

The Chlorophyceae composed 28.8 percent of the total plankton in October, declined to almost complete absence in January, February, and March and then rose to 80.7 percent of the total population in June (Table I). The Chlorophyceae represented were:

1. Cerasterias
2. Characium
3. Chlamydomonas
4. Cladophora
5. Closteriopsis
6. Closterium
7. Coelastrum
8. Crucigenia
9. Desmidium

10. Klebsatothrix
11. Endorina
12. Gonium
13. Hormidium
14. Micractinium
15. Microspora
16. Oedocladium
17. Oedogonium
18. Ourococcus
19. Pachycladon
20. Pascheriella
21. Pediastrum
22. Planktosphaeria
23. Protococcus
24. Pteromonas
25. Rhizoclonium
26. Scenedesmus
27. Schizogonium
28. Selenastrum
29. Sphaerocystis
30. Spirogyra
31. Staurastrum
32. Stigeoclonium
33. Ulothrix
34. Westella

The remainder of the algae were listed together. They never made up a particularly important group in numbers, presenting individual peaks, one succeeding another. This occurred with only small numbers present except that in the case of Mallomonas a peak on January 31 reached 112,000 individuals per liter. The remainder of the algae identified were:

1. Asterionella
2. Bumilleria
3. Ceratium
4. Epithemia
5. Fragilaria
6. Frustulia
7. Glenodinium
8. Gomphosphaeria
9. Gyrosigma
10. Mallomonas
11. Melosira
12. Meridion
13. Merismopedia
14. Microcystis
15. Navicula
16. Nitzchia
17. Opephora
18. Oscillatoria
19. Peridinium
20. Pinnularia

21. Rhoicosphenia

22. Spirulina

23. Stauroneis

24. Surirella

25. Synedra

In all 67 genera of algae were identified. For convience, the plankton was divided into 4 groups as shown in Table I. Here each group is shown with its monthly percentage of total plankton. Figures 1, 2, 3, and 4 give the actual numbers per liter of the algal groups along with the numbers of the total algae counted.

TABLE I

AVERAGE MONTHLY PERCENTAGE
COMPOSITION OF PLANKTON

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
Euglenophyceae	58.7	91.5	96.2	66.8	96.2	97.7	91.6	40.3	14.9
Chlorophyceae	28.8	7.1	2.1	0.0	0.0	0.0	4.8	50.0	80.7
Rest of Algae	5.3	.5	.5	31.7	1.6	.7	1.5	3.2	2.8
Zooplankton	7.2	.9	1.2	1.5	2.2	1.6	2.1	6.5	1.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

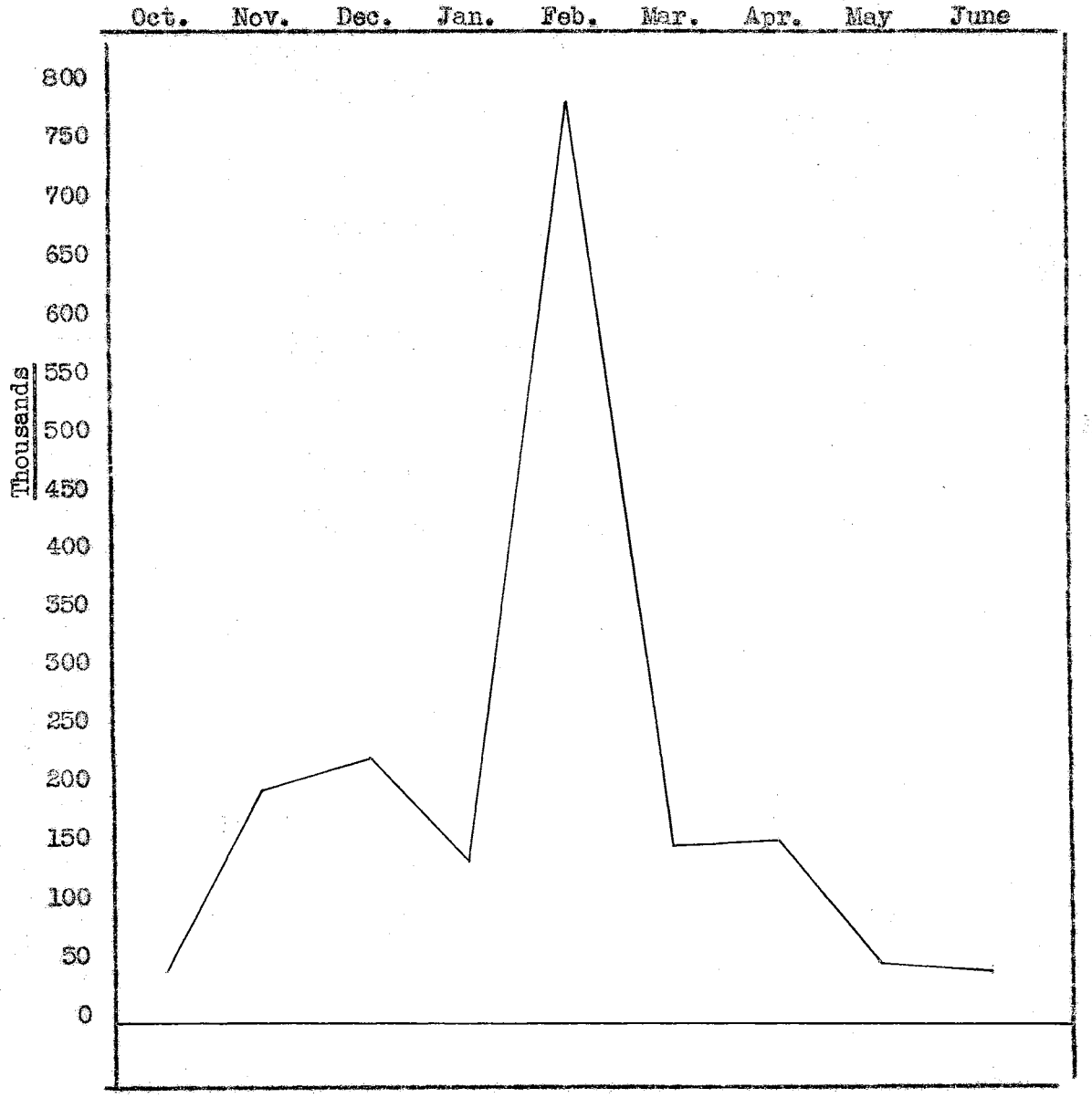

Figure 1. Graph showing total number of Euglenophyceae in actual numbers per liter.

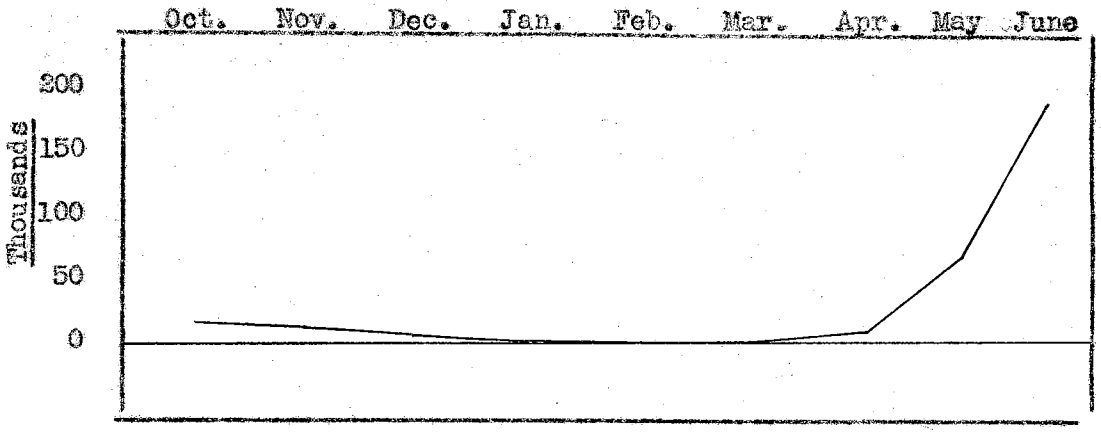

Figure 2. Graph showing total number of Chlorophyceae in actual numbers per liter.

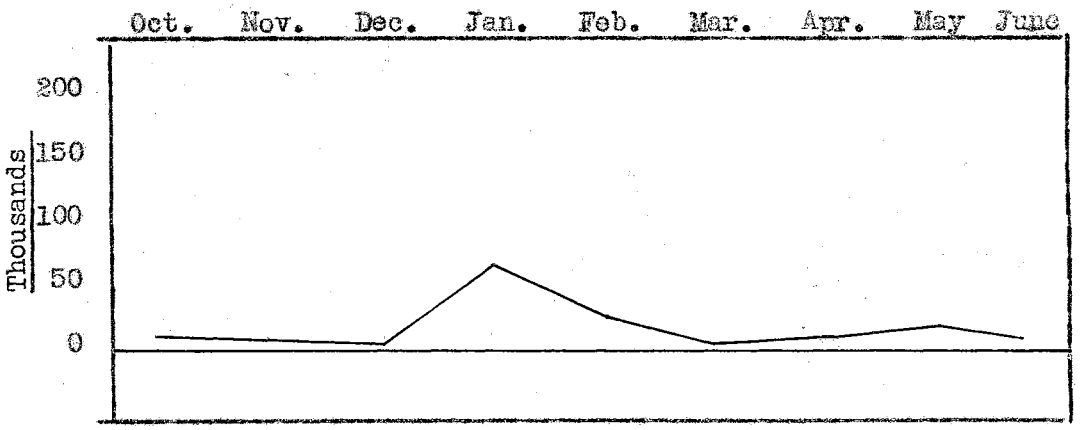

Figure 3. Graph showing numbers of Algae exclusive of Euglenophyceae and Chlorophyceae in actual numbers per liter.

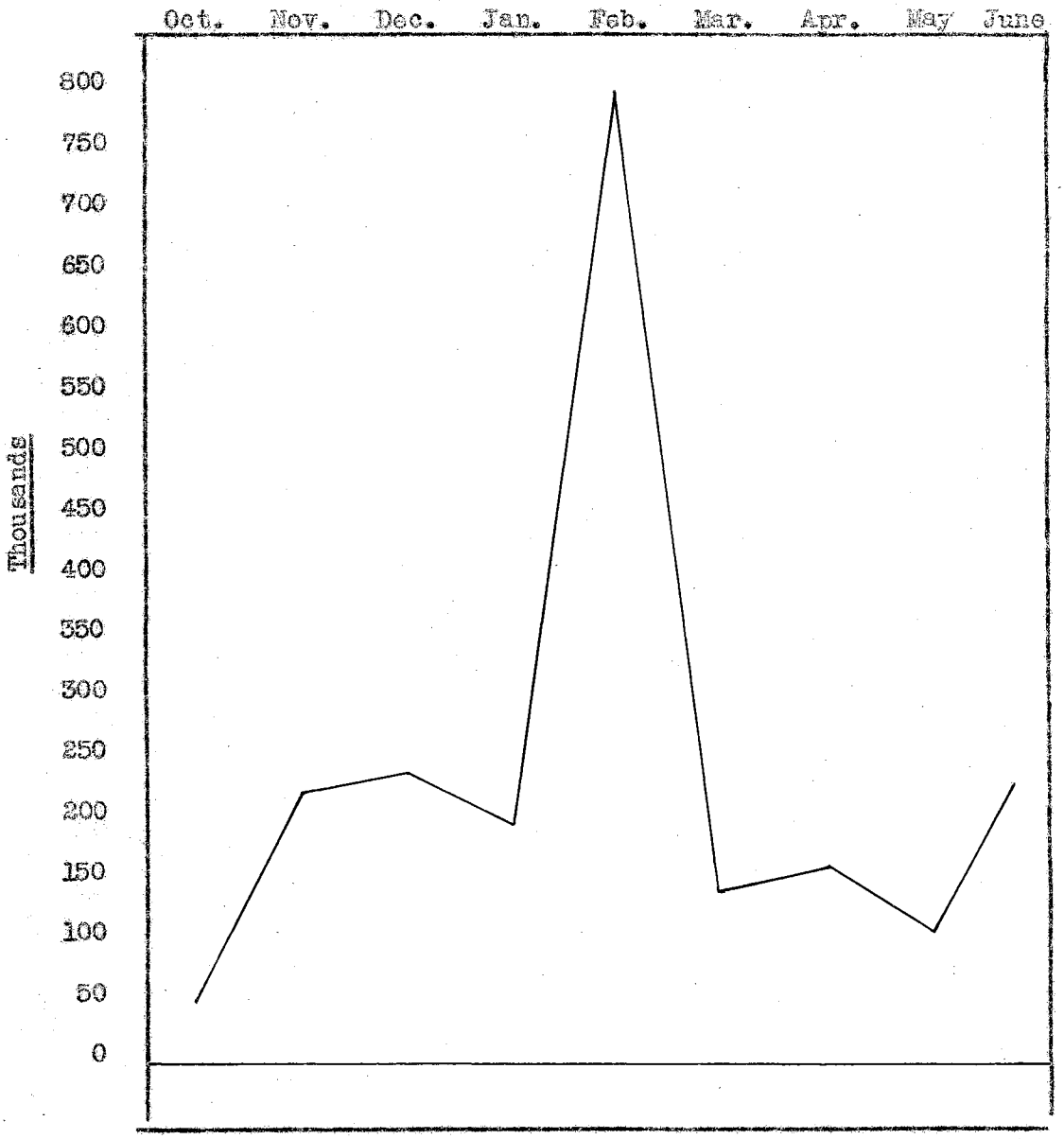

Figure 4. Graph showing the total algae present in actual numbers per liter.

II. Zooplankton

At no time did the zooplankton population reach as high a peak in numbers as the phytoplankton, although 43 genera were identified from the samples. Due to the size of some, especially Copepoda, Cladocera, and Ostracoda, there would at times have been more weight of zooplankton than of phytoplankton. Seven groups of organisms that were collected with the plankton were not identified to genera. These were Diptera larvae, Neuroptera naiad, Collembola, Ostracoda, Nematoda, nauplii, and telotroch. Following are the zooplankters identified:

Protozoa

Sarcodina

1. Arcella
2. Centropyxis
3. Difflugia

Ciliata

1. Carchesium
2. Codonella
3. Coleps
4. Condylostoma
5. Didinium
6. Halteria
7. Paramecium
8. Pyxidium
9. Rhabdostyla
10. Spirostomum
11. Stentor

12. Stylonychia
13. Tintinnopsis
14. Trachelius
15. Trichodina
16. Vaginicola
17. Vorticella
18. telotroch (Vorticellidae larvae)

Rotifera

1. Anuraea
2. Asplanchna
3. Brachionus
4. Cathypnea
5. Colurus
6. Furcularia
7. Noteus
8. Polyarthra
9. Rattulus
10. Rotifer
11. Synchaeta

Platyhelminthes

1. Dalyellia

Bryzoa

1. Plumatella (statoblast only)

Annelida

1. Nais

Arthropoda

Cladocera

1. *Alona*
2. *Bosmina*
3. *Chydorus*
4. *Daphnia*
5. *Ilyocryptus*
6. *Leydigia*
7. *Pleuroxus*

Copepoda

1. *Cyclops*
2. *Diaptomus*
3. nauplius (larval form)

Collembola

Diptera (larvae)

Neuroptera (naiad)

The numbers of zooplankton are plotted together (figure 5). In figure 6, the total plankton populations are shown.

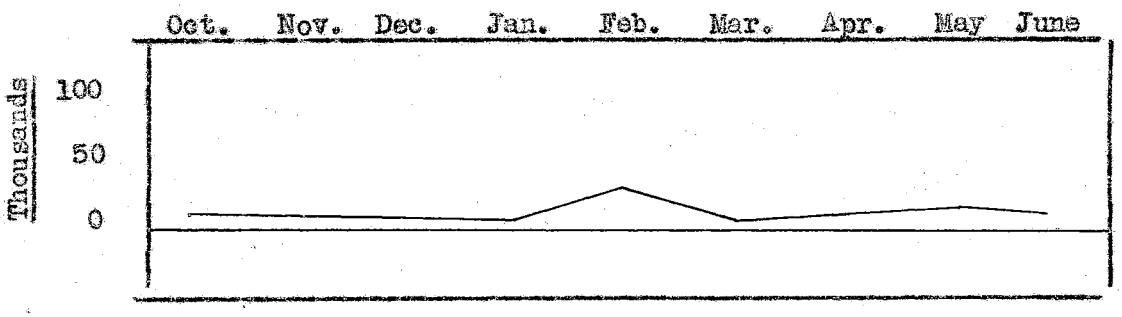

Figure 5. Graph showing total population of zooplankton in actual numbers per liter.

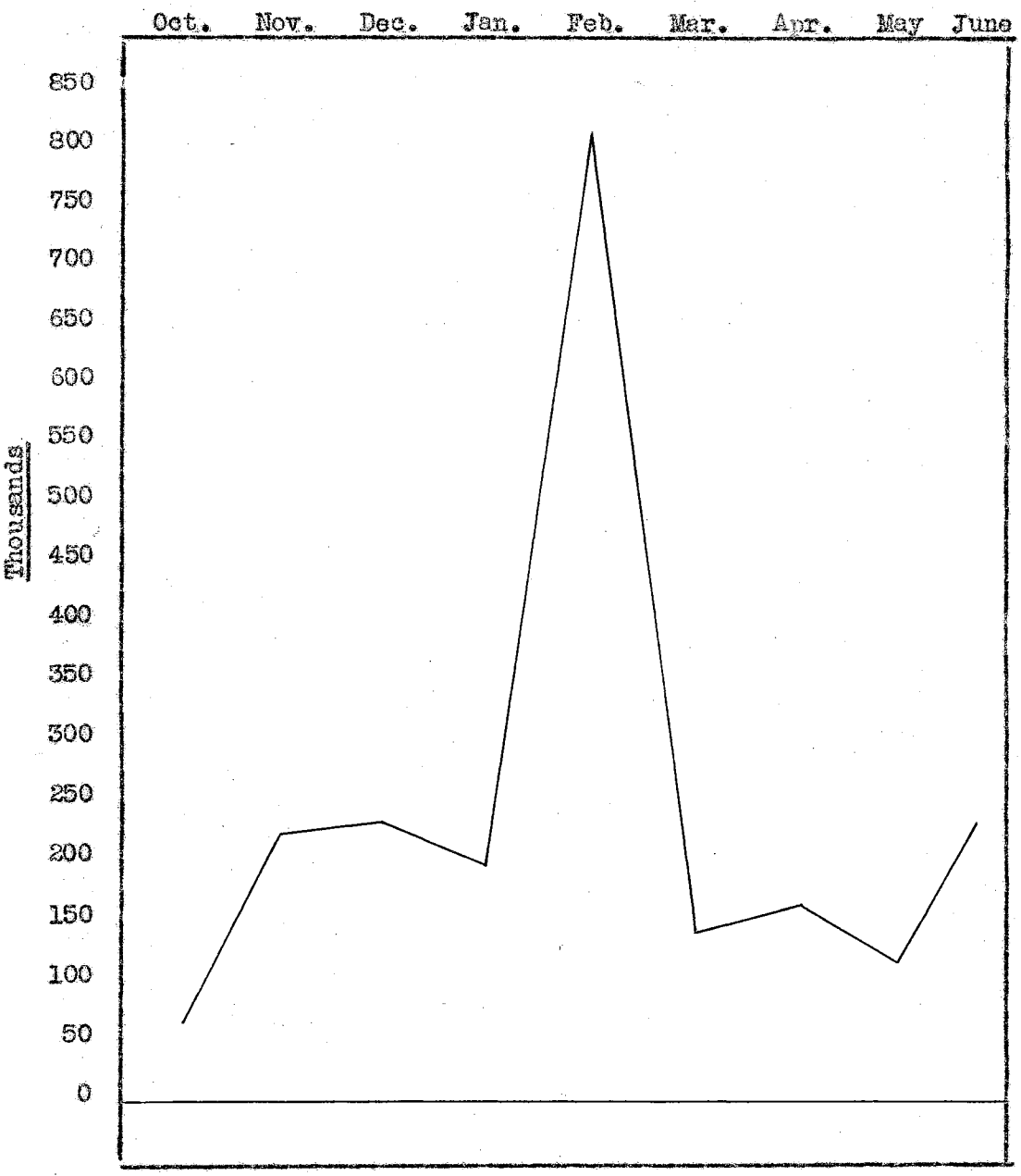

Figure 6. Graph showing total plankton population in actual numbers per liter.

III. Discussion

Heavy run-offs from the watershed would cause a great exchange of water in the pond, carrying away organisms as well as the dissolved fertilities, thus resulting in a low plankton population. The rainfall records as recorded at the Oklahoma A. & M. College Weather Substation reveal that rainfall producing a heavy water exchange in the pond was followed by a decided reduction in plankton numbers (Figure 7). This is evident when one notes that in the latter part of September an extremely heavy run-off from rains flushed the pond to a great extent suggesting a reason for the low plankton population during October.

There was developed fall and spring pulses of Chlorophyceae with a definite predominance of Euglenophyceae in mid-winter (Table I). Continuted study would be necessary to determine whether similar pulses occur seasonally each year.

It seems possible that the addition of large amounts of sludge to this pond influenced the size of the plankton population and thus may have been a factor leading to the development of Euglenophyceae numbers.

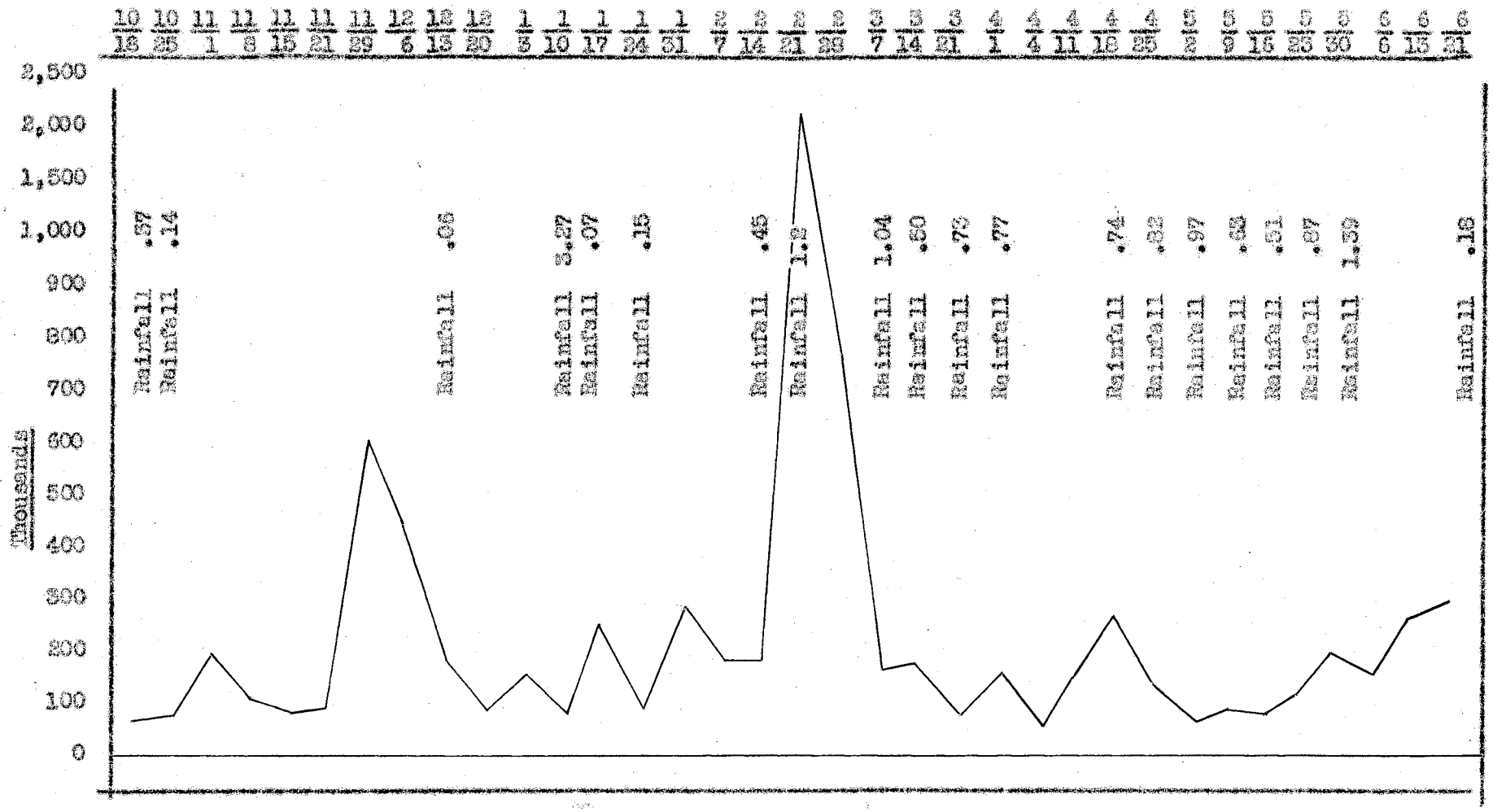

Figure 7. Graph showing weekly total population of Plankton and amounts of weekly rainfall.

Summary

1. Qualitative and quantitive studies were made, based on 35 weekly collections of plankton taken from a pond fertilized with sludge.
2. A total of 117 forms are listed of which 67 are genera of phytoplankton, 43 are genera of zooplankton, and 7 are kinds of organisms that were not identified to genera, 5 being immature stages.
3. Euglenophyceae composed more than 50 percent of the total plankton crop from October through April, and during May and June the Chlorophyceae became most numerous. The Chlorophyceae numbers decreased during the winter months and increased again in the spring.
4. Apparently one of the factors interrupting a consistent population was the exchange of water in the pond as a result of heavy rains.

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